

LICENSEE EVENT REPORT (LER)

Form Rev. 2.0

Facility Name (1) Quad Cities Unit One										Docket Number (2) 0 5 0 0 0 2 5 4										Page (3) 1 of 6																													
Title (4) The Unit One High Pressure Coolant Injection System Was Inoperable Due to a High Pressure Pump Thrust Bearing Oil Leak Which Was Caused by an Improper Setting of the Thrust Bearing																																																	
Event Date (5) Month: 0 8 1 3 Year: 1998										LER Number (6) Year: 1998 Sequential Number: 0 2 0 Revision Number: 0 0										Report Date (7) Month: 0 9 1 1 Year: 1998										Other Facilities Involved (8) Docket Number(s): 0 5 0 0 0																			
OPERATING MODE (9) 1										THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)																																							
POWER LEVEL (10) 1 0 0					20.402(b)					20.405(c)					50.73(a)(2)(iv)					73.71(b)																													
					20.405(a)(1)(i)					50.36(c)(1)					X 50.73(a)(2)(v)					73.71(c)																													
					20.405(a)(1)(ii)					50.36(c)(2)					50.73(a)(2)(vii)					Other (Specify in Abstract below and in Text)																													
					20.405(a)(1)(iii)					50.73(a)(2)(i)					50.73(a)(2)(viii)(A)																																		
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LICENSEE CONTACT FOR THIS LER (12)																																																	
Name Charles Peterson, Regulatory Affairs Manager, ext. 3609															TELEPHONE NUMBER AREA CODE: 3 0 9 6 5 4 - 2 2 4 1																																		
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																																																	
CAUSE					SYSTEM					COMPONENT					MANUFACTURER					REPORTABLE TO EPIX					CAUSE					SYSTEM					COMPONENT					MANUFACTURER					REPORTABLE TO EPIX				
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SUPPLEMENTAL REPORT EXPECTED (14)																																																	
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)															<input checked="" type="checkbox"/> NO																																		
Expected Submission Date (15)															Month					Day					Year																								
ABSTRACT (Limit to 1400 spaces, i.e. approximately fifteen single-space typewritten lines) (16)																																																	

ABSTRACT:

On 08131998, a steady stream of oil was found leaking from the outboard (thrust) bearing housing of the Unit 1 (U-1) High Pressure Coolant Injection (HPCI) System Main Pump. The U-1 HPCI subsystem had previously entered a 14 day Limiting Condition for Operation (LCO) per Technical Specification 3.5.A.3 Action 3 at 2357 on 08121998, due to a problem with the turbine turning gear. The subsystem remained inoperable to repair this oil leak.

The HPCI pump oil leak was repaired. The HPCI pump operability surveillance was performed and the subsystem was declared operable on 08171998.

This failure was caused by improper setting of the U-1 HPCI pump thrust at some time in the past. The time and cause of the improper setting could not be determined.

Routine preventive maintenance activities will be initiated for the HPCI pumps, including checks on the thrust bearing setting and HPCI pump/turbine couplings. Maintenance procedures and training will be reviewed to determine if changes are needed to improve direction in the area of setting pump thrust.

The Reactor Core Isolation Cooling (RCIC) System and the required low pressure Emergency Core Cooling Subsystems (ECCS) remained operable throughout this event. Therefore, the potential safety consequences to the public and to control room personnel were minimal.

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- The thrust disk thickness varied at different locations on the disk by more than the manufacturer's recommendations (0.005 in. versus 0.0005 in.).
- The outer oil seal ring for the thrust bearing was damaged on the inner diameter surface that contacts the pump shaft and on the face of the ring.
- The journal bearing showed slight wear on the upper half surface.
- Two foreign objects were found between the faces of the flexible coupling spool piece and the pump shaft/coupling hub. The objects were made of metal and were 5/8 in. and 3/16 in. in diameter. The larger object had worn a depression about a 1/4 in. deep in the end of the pump shaft and coupling spool piece face.
- The circumference of the pump shaft was examined for cracking and no cracks were found.

These facts lead to the following root cause of this failure. The thrust setting was incorrect for the U-1 Main HPCI Pump. Due to the close tolerance between the oil deflector and the bearing housing, this excessive thrust setting most probably allowed the oil deflector to move far enough to come into contact with the bearing housing. Once the oil deflector came into contact with bearing housing, it became overheated and failed. This overheating caused the pump shaft to overheat and probably caused the shaft to come into contact with the oil seal ring and journal bearing, causing the observed damage to the oil seal ring and the wear in the upper half of the journal bearing. These failures were the cause of the oil leakage observed on 08131998.

Therefore, the root cause of this event was the improper setting of Unit 1 HPCI thrust bearing. A review of the available work history for this pump did not show any evidence of this thrust bearing having been reset. Therefore at some undetermined time in the past, the thrust for this pump was set incorrectly. This incorrect setting eventually led to the failure as outlined above.

The cause of the foreign objects in the pump coupling could not be determined. It is not believed these foreign objects contributed to the failure of the oil deflector and subsequent oil leak.

This root cause determination was discussed with a ComEd pump component expert and with a Byron/Jackson Company pump engineer. Both agreed this is the most probable failure scenario.

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D. SAFETY ANALYSIS:

The consequences of this event were minimal.

The Quarterly HPCI Operability (QCOS 2300-05) surveillance was performed immediately preceding this event. Therefore, the subsystem was capable of performing its design function up until the time the leak was discovered on 08131998. Additionally, even with the observed leakage, the HPCI pump would have run for several hours prior to running low on oil and failing. The U-1 HPCI subsystem was not available to perform its design function for 74.4 hours during this event.

The Reactor Core Isolation Cooling System, Automatic Depressurization System and Low Pressure Coolant Injection System were operable during this event and would also have provided redundant protection for the fuel in the event of a Loss of Coolant Accident. Therefore, the effect on the public and the control room personnel was minimal

E. CORRECTIVE ACTIONS:

Corrective Actions Completed:

1. The main pump thrust bearing was overhauled.
2. The main pump thrust was set to the manufacturer's recommendation.
3. Foreign objects were removed from the pump coupling.
4. The bearing oil deflector was replaced.
5. The HPCI oil junction box strainers and the oil filters were inspected for foreign material.
6. All oil deflectors on both the U-1 and U-2 HPCI pumps were verified to be tight on the pump shafts. As a result of this inspection, one oil deflector on the U-2 HPCI main pump journal bearing was tightened. This further indicates that the U-2 HPCI Pump Thrust Bearing does not have the same problem as observed on the U-1 HPCI pump.
7. The Quarterly HPCI Pump Operability Test was completed after the repairs to the thrust bearing.
8. A Magnetic Particle Inspection was completed on the end of the pump shaft to verify no cracking was present, due to the foreign objects found in the pump coupling.
9. The foreign objects recovered from the pump coupling were analyzed to determine the composition of the material.
10. The oil deflector was examined by System Materials Analysis Department and Corporate Engineering to determine the cause of the failure.

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Corrective Actions to be Completed:

1. Routine preventive maintenance inspections of the HPCI pumps will be initiated. This inspection will include a check of the pump thrust bearing to verify the oil deflectors are properly attached to the pump shafts. The thrust bearings will be examined in accordance with the Manufacturer's recommendations, i.e. once a year initially and then the frequency could be reduced, based on the results of the initial inspections. This preventive maintenance predefine will be initiated by 12311998. (NTS25418098CAQS00020.01; Maintenance)
2. A routine preventive maintenance inspection of the HPCI pump and turbine couplings will be initiated by 12311998. (NTS25418098CAQS00020.02; Maintenance)
3. A review of the effectiveness of maintenance training, in the area of properly setting the thrust on a pump, will be completed by 10301998. A determination will be made if additional training is necessary and whether a pump/bearing manufacturer should be brought on-site to properly train the Station's instructors. (NTS25418098CAQS00020.03; Training)
4. A review of the effectiveness of maintenance procedures in the area of properly setting the thrust on a pump, will be completed by 03011999. A determination will be made if procedure changes are needed. (NTS25418098CAQS00020.04; Maintenance)
5. Following the effectiveness reviews of maintenance procedures and training, review other equipment that might have had the thrust improperly set. If it is determined that other equipment is affected, preventive maintenance activities will be scheduled on that equipment. This review and any necessary scheduling will be completed by 01191999. (NTS 25418098CAQS00020.05; Maintenance)

F. PREVIOUS OCCURRENCES:

A search was performed of the LER database for improper maintenance work practices at Quad-Cities Station in the last two years. The following LER was identified as having a similar causal factor:

265/97-012, "Loss of Shutdown Cooling Due To The Loss Of Power To The Reactor Protection Bus 2B."

The output voltage for this LER had been incorrectly set and the corrective actions included developing a preventive maintenance (PM) procedure, performing PM on the voltage regulating transformers at a regular interval and revising the procedure to include voltage verifications. The corrective actions were equipment specific and would not have prevented this type of inappropriate maintenance work practice.

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G. COMPONENT FAILURE DATA:

Component Description: Turbine Driven Pump

Manufacturer: Byron Jackson

Model Number: DVMX